What is claimed is:

1. An tunable optical device, comprising:

a holographic element, having a hologram therein which has a predetermined relationship to a plurality of wavelengths;

a wavelength varying element, coupled to said holographic element, and varying said predetermined relationship; and

a first optical system, handling first wavelengths of an optical signal which pass through said holographic element without being changed by said hologram as an output signal; and

a second optical system, separate from said first optical system, and handling a second optical signal including said wavelength having said predetermined relationship as varied by said wavelength varying element.

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2. A device as in claim 1, wherein said wavelength varying element includes an element which physically moves said hologram.

3

3. A device as in claim 1, wherein said hologram includes an electro-optic storage medium, and wavelength varying element includes a voltage system that changes an index of refraction of said electro optic storage medium.

4. A device as in claim 1, wherein said second optical system handles wavelengths to be dropped.

5. A device as in claim 4, wherein said holographic element includes a hologram form therein which includes a plurality of different Bragg matching conditions depending on an angle of incidence with respect to an orientation of the hologram, and said wavelength varying element includes an element which physically moves said hologram to apply said optical signal through a different orientation of said hologram which has different Bragg matching characteristics.

6. A device as in claim 5 wherein said physically moving comprises rotating said hologram.

7. A device as in claim 6 wherein said rotating comprises rotating said hologram to form a section of a cone.

8. A device as in claim 5, further comprising a mirror, and wherein said element that moves comprises an element moving said mirror to change an incidence of said optical signal on said hologram.

9. A device as in claim 1 wherein said output signal extends in substantially a same direction as an input signal.

10. A device as in claim 1 wherein said output signal travels in substantially an opposite but parallel direction to an input signal.

11. A device as in claim 4 wherein said second optical signal is a drop output signal which travels in a different direction than either an input signal or said output signal.

12. A device as in claim ~~11~~, wherein said different direction is substantially perpendicular to said input signal.

13. A device as in claim 9, further comprising a double prism forming a retroreflecting operation to reflect the output signal in said opposite direction.

14. A device as in claim 1, further comprising an optical detector, receiving said drop signal, and converting said drop signal to an electrical signal indicative thereof.

15. A device as in claim 14, further comprising a laser element, receiving said electrical signal and converting said electrical signal to an optical signal.

16. An apparatus as in claim 15 wherein said laser is a DFB laser.

17. A device as in claim 1, wherein said hologram comprises a light diffracting structure.

18. A device as in claim 4 further comprising an add port, allowing additional wavelengths to be added to the output signal.

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19. An apparatus as in claim 18, wherein said add port comprises a Y junction.

20. A device as in claim 1, wherein said holographic element includes a hologram form therein which includes a plurality of different Bragg matching conditions depending on an angle of incidence with respect to an orientation of the hologram, and said wavelength varying element includes an element which physically moves a direction of an input light beam relative to said hologram to apply said optical signal through a

different orientation of said hologram which has different Bragg matching characteristics.

21. A device as in claim 1, wherein said second optical system handles wavelengths to be added.

22. A device as in claim 1, wherein said holographic element includes said hologram forming a grating as part of said holographic element, said grating interacting with a wavelength based on a characteristic of a material forming said holographic element.

23. A device as in claim 22, further comprising electrodes which apply an electric field to said holographic element to change a characteristic of the material and thereby change the reflection wavelength of said grating.

24. A device as in claim 22, further comprising a plurality of mirrors, reflecting said optical signal to exit along an axis parallel to an axis of its entry.

25. A device as in claim 18, wherein said second optical signal travels in substantially a same direction as said first optical signal.

26. A device as in claim 18, wherein said second optical signal travels in a direction which is substantially 180 degrees opposite from said first direction.

27. A device as in claim 1, wherein said first optical signal travels in a different direction than said second optical signal.

28. A device as in claim 1, wherein said first optical system includes a first side of a first mirror, and said second optical system includes a second side of the first mirror.

29. A device as in claim 28, wherein said first mirror is movable to change a direction of reflection of the signal.

30. A device as in claim 1, wherein said first optical system includes a lens.

31. A device as in claim 30, wherein said lens is a GRIN lens.

32. A device as in claim 30, wherein said first optical system further comprises a mirror, at an output of said lens, reflecting output light towards said holographic element.

33. A device as in claim 32, further comprising a second mirror, located to reflect light which has passed through said holographic element back towards said holographic element, and to said first mirror, which reflects said light in a first direction, and further comprising an output waveguide, located adjacent said light which is reflected in said first direction to receive said output light.

34. An apparatus as in claim 33, further comprising a third mirror, positioned to receive light which has been changed by said hologram to reflect said light in a specified direction.

35. A device as in claim 34, wherein said third mirror is a retroreflector.

36. A method as in claim 35 wherein said retro reflector reflects light back towards said first mirror, to be reflected by said first mirror.

37. A device as in claim 36, wherein said light reflected by said first mirror after said retroreflector is reflected in a second direction, and further comprising a waveguide for the drop channel, receiving said light reflected in said second direction.

38. A method, comprising:

applying an input optical signal having a plurality of wavelengths therein to an area of a hologram;

tuning said hologram to one of a plurality of wavelengths; and

using said hologram to separately optically process said one of said wavelengths differently from others of said wavelengths.

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39. A method as in claim 38, wherein an output signal includes all wavelengths except said one of said wavelengths and producing a dropped signal includes only said one of said wavelengths.

40. A method as in claim 39, further comprising changing a direction of said dropped signal using said hologram.

41. A method as in claim 38, wherein said adjusting comprises physically moving said hologram.

42. A method as in claim 38, wherein said adjusting comprises applying an electric field to said hologram.

43. A method as in claim 38, further comprising using said hologram to merge said one of said wavelengths as added signal with others of said wavelengths as an output signal.

44. A method as in claim 38, wherein said adjusting comprises moving an angle of incidence of light into said hologram.

45. A method as in claim 42, wherein said hologram includes a grating formed therein.

46. A method as in claim 45, wherein a resonant frequency of said grating depends on characteristics of the material forming said hologram.

47. A method as in claim 46, wherein said applying an electric field comprises using said electric field to change characteristics of the material forming said hologram.

48. A method as in claim 47, wherein said characteristics that are changed include refractive index.

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49. A method as in claim 48, wherein said first optical output signal travels in substantially a same direction as said input optical signal.

50. A method as in claim 38, wherein a first optical output signal including said one of said wavelengths travels in substantially an opposite direction from an input optical signal.

51. A method as in claim 38, wherein a first optical output signal including said others of said wavelengths and a second optical output signal including said one of said wavelengths travel in different directions.

52. A method as in claim 51, wherein said first and second output signals have a constant angle therebetween.

53. A method as in claim 38 wherein said using comprises changing a direction of said one of said wavelengths to a different direction than another of said wavelengths.

54. A method as in claim 38, wherein said tuning comprises moving said hologram.

55. A method as in claim 38, wherein said tuning comprises moving said incident light to a different angle.

56. A method as in claim 38, wherein said tuning comprises changing a characteristic of the hologram.

57. A method as in claim 56, wherein the changing the characteristic of the hologram comprises electrically changing the characteristic of the hologram.

58. A method as in claim 57, wherein said electrically changing the characteristic of the hologram comprises applying an electric field to a material containing the hologram.

59. A method as in claim 38, further comprising adding an additional optical wavelength to said output signal.

60. An apparatus, comprising:

an optical filter element comprising a hologram material with a hologram form thereon;

an optical system, positioned to apply an optical signal to said hologram;

a tuning element, changing a way that said optical signal is applied to said hologram to change a Bragg matching condition between said optical signal and said hologram and thereby Bragg match to a different resonant wavelength in said optical signal;

a first output path for light that is not Bragg matched to said hologram extending in a first direction,

and

a second output path for light that is Bragg matched to said hologram of extending along a second optical path, wherein said second optical path is in a different direction than said first optical path.

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61. A system as in claim 60, wherein said moving comprises moving said hologram.

62. An apparatus as in claim 60, wherein said moving comprises moving an incident angle of the light.

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63. A system as in claim 61, wherein said moving said hologram moves said hologram in a way which forms a substantially cone shape.

64. An apparatus as in claim 60, further comprising an add port, which allows adding additional wavelengths to the output signal.

65. An apparatus, comprising:

an optical filter element comprising a hologram material with a hologram form thereon, said optical filter element comprising a holographic material, first and second electrodes formed on said holographic material; and an electrical tuning element, which applies electric signals across said first and second electrodes to change a Bragg matching condition of said hologram and thereby Bragg match to a different resonant wavelength in said optical signal;

an optical system, positioned to apply an optical signal to said hologram;

a first output path for light that is not Bragg matched to said hologram extending in a first direction; and

a second output path for light that is Bragg matched to said hologram of extending along a second optical path, wherein said second optical path is in a different direction than said first optical path.

66. An apparatus as in claim 65, further comprising an add port, enabling adding signals to said output signal.

67. An apparatus as in claim 65, wherein said material is a polymer.

68. An apparatus as in claim 65, wherein said material is a liquid crystal.

69. A apparatus as in claim 65, wherein said material is an electro-optic storage medium.

70. A apparatus as in claim 69, wherein said electro-optic storage materials is one of an electro-optic polymers or an electro optic crystal.

71. An apparatus as in claim 69, wherein said electro optic storage medium is one of lithium niobate, barium titanate, potassium niobate, strontium-barium niobate mixed, and potassium-tanatalate niobate mixed crystals.

72. An tunable optical device, comprising:

a holographic element, having a holographic element therein which has a predetermined Bragg matching relationship to a plurality of wavelengths depending on an orientation parameter;

a wavelength varying element, changing said orientation parameter;

an optical system, receiving first wavelengths of an optical signal which has passed through said holographic element without being changed by said hologram as an output signal in a first direction, and receiving a second optical signal including said wavelength having said predetermined relationship in a second direction.

73. A device as in claim 72, wherein said optical system further includes an element which applies light to said hologram to merge said one of said wavelengths as added signal with others of said wavelengths as an output signal.

74. A device as in claim 72, wherein said hologram includes a diffraction structure therein.

75. A device as in claim 72, wherein said hologram includes a grating therein.

76. A device, comprising:

a holographic material, including a holographic grating formed therein;

an optical system, providing an input optical beam to said holographic material, and obtaining an output optical beam from said holographic material, said input and output optical beams being different; and

a tuning system, which tunes the way in which said input and output beam are different by varying an effective period length of a holographic grating.

77. A device as in claim 76, wherein said tuning system comprises an element which mechanically rotates said holographic material.

78. A device as in claim 76, wherein said tuning system comprises an element which changes a refractive index of said holographic material.

79. A device as in claim 78 wherein said element which changes a refractive index comprises a voltage source, and said holographic material is formed of a material whose refractive index is altered by application of an electric field.

80. A device as in claim 79, wherein said holographic storage material is one of an electro-optic polymer, liquid-crystal dispersed polymers, and electro-optic oxide crystals such as lithium niobate, barium titanate, potassium niobate, strontium-barium niobate mixed, and potassium-tanatalate niobate mixed crystals.

81. A device as in claim 76, wherein said tuning system comprises an element which changes an angular orientation of an input optical beam.

82. A device as in claim 81, wherein said tuning system comprises a movable mirror.

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83. A device as in claim 76, wherein said output optical beam includes a first and output optical beam and a dropped optical beam, extending in different directions, said first output optical beam having at least one frequency band removed relative to said input optical beam.

84. A device as in claim 76, wherein said input optical beam includes a first input optical beam, and a second input optical beam with at least one wavelength range to be added to contents of said first input optical beam, said first and second input optical beams coming from different directions.

85. A device as in claim 76 wherein said input optical beam and said output optical beam have parts which extend in substantially the same directions.

86. A device as in claim 85, wherein said output optical beam includes a first output optical beam, and a dropped portion, and wherein said first output optical beam extends in substantially the same direction as said input optical beam, and wherein said dropped portion extend sin a substantially different direction than said input optical beam.

87. A device, comprising:

a holographic storage element, formed with a hologram therein in the shape of a grating; and

an optical tuning element, tuning an operation of said holographic storage element to react to different optical frequencies.

88. A device as in claim 87, further comprising an optical system, coupling an input optical beam to said hologram.

89. A device as in claim 87, wherein said optical tuning element operates to change an optical angle of incidence of an input optical signal.

90. A device as in claim 87, wherein said optical tuning element operates to change a mechanical orientation of said holographic storage element.

91. A device as in claim 87, wherein said optical tuning element operates to change an index of refraction of a medium of said holographic storage element.

92. A device as in claim 91, wherein said holographic storage element is formed of an Electro optic material, and said optical tuning element changes a voltage across said Electro optical material.

93. A device as in claim 88, wherein said optical system includes an input optical fiber, an output optical fiber, and a dropped output optical fiber, wherein said hologram operates to diffract said different optical frequencies selected by said optical tuning element, to said dropped output optical fiber.

94. A device as in claim 88, further comprising a repeater element, receiving an output optical signal, converting said output optical signal to an electrical signal, and reconverting said electrical signal to an optical signal.

95. A device as in claim 93, wherein said optical system includes a double prism, which reflects an output optical signal back in the direction of its incidence, said double prism located in a direction where it will not contact a dropped optical signal for said dropped output optical fiber.

96. A device as in claim 87, wherein said optical tuning element changes an effective period length of the holographic grating.

97. A device as in claim 92, wherein said changing a voltage comprises changing the voltage to change a refractive index of the crystal between 1.35 and 1.45.

98. A device as in claim 89, wherein said changing element is a movable mirror.